KWINIUK RIVER SALMON
COUNTING TOWER REPORT
1970

Prepared by:

Charles L. Hurd
Assistant Area Management Biologist
Arctic-Yukon-Kuskokwim Area
Commercial Fisheries Division
Alaska Department of Fish and Game
212 East International Airport Road
Anchorage, Alaska

KWINIUK RIVER COUNTING TOWER PROJECT, 1970

INTRODUCTION

A salmon counting tower project was initiated in 1965 on the Kwiniuk River 110 miles east of Nome (Figure 1). The sixth season of operation was completed in 1970. The Kwiniuk River, similar to other major rivers in Norton Sound, receives moderate runs of chum and pink salmon which are harvested by subsistence and commercial fishermen. To effectively manage the Norton Sound fisheries, it is important that frequent estimates of escapement during the season be obtained either by tower counts or aerial survey counts. The tower count is the more precise method and provides a check on the aerial surveys conducted.

OBJECTIVES

The 1970 Kwiniuk River counting tower objectives were to:

1. Obtain daily and seasonal timing and magnitude of salmon escapements.

2. Evaluate aerial survey estimates by comparison with counting tower enumerations of salmon escapements.

3. Observe salmon behavior in the Kwiniuk River.

4. Periodically sample the Moses Point commercial salmon fishery and the escapement populations for age, sex and size information.

5. Conduct a late season salmon carcass survey of the Tubutulik River to determine species composition.

METHODS AND MATERIALS

A portable 20-foot aluminum counting tower was erected adjacent to the river upon a 30-foot high bank at the same location used since 1965, approximately five miles above the river mouth. A 25-fathom beach seine was used to block a secondary channel formed by a mid-river sand bar located across the main channel from the tower.

A power line with two 400-watt incandescent light bulbs, housed in 18-inch diameter reflectors, was strung across the main channel to provide illumination during darkness. A 1250-watt generator provided electric current for the lights.

A three-man crew began 18-hour counting operations on June 25 and terminated counting operations on July 29, 1970. Each crew member counted salmon for two three-hour shifts daily from 1200 until 0600 the next day. Hourly counts were totaled. Salmon moving downstream were subtracted from the total count. Based upon past years recommendations, ten minute counts were discontinued.

Two aerial surveys were conducted from a chartered Cessna 180 aircraft.

The commercial fishery catches were periodically sampled for age, sex and size information at the river mouth. The escapement population was sampled above the tower site using a beach seine to capture the fish.

A carcass survey was made of the Tobutulik River from a point approximately one mile below Chukajak Creek to the mouth of the main river. The survey was conducted by two men in an outboard powered aluminum canoe on July 29-30.

RESULTS

Estimates of escapements from tower counts

In 1970 a total of 66,604 chums and 226,831 pinks were counted past the tower. Based upon research data from the past five seasons, the average chum salmon escapement during the six hours from 0600 until 1200 was 2.1% of the total run (1,400), and the average for pink salmon was 3.66% of the total run (8,300). Using these figures, the expanded total escapements were 68,004 chums and 235,131 pinks. Daily cumulative counts for 1965-1970[1/] are presented in Appendix Table 1.

The main peaks of the chum run occurred during the periods July 2-6 and July 14-17, while the peak of the pink run passed the tower during the period July 15-17 (Figure 2). The daily chum run was heaviest during the hours from 1500 to 0100 with the largest counts occurring from 2100 to 2200. The pink migration was greatest during a similar period, 1500 to 2400, with the peak also occurring from 2100 to 2200 hours (Table 1). The chum and pink salmon average daily peak of migration for the years 1965-1969 was greatest between the hours of 1900 and 2000 (Appendix Table 2).

1/ Historical data from 1968 and 1969 research project reports.

The 1970 chum salmon escapement was the highest ever recorded. The pink salmon escapement, a 1.8 fold increase over the 1968 high brood year escapement of 126,764 fish, was also the highest recorded. This was the third consecutive year of high pink salmon abundance. Total chum and pink escapements for 1965-1970 are presented in Appendix Table 3.[1/]

Commercial Fishery Catches

In 1970 the Moses Point commercial fishery harvest was greatest for chums during the period July 3-8 with another smaller peak on July 16. The highest pink harvest occurred on July 17 (Table 2). These dates correspond closely with the Kwiniuk River migration patterns (Figure 2).

Future Escapement Predictions Based upon Tower Count Data

Determination of the 1967 brood year chum survival rate based upon the known survival rate of the same brood year of pinks, which returned in 1969, will be tested.[2/] Four years of Kwiniuk tower counts provide the basic data for comparison. Unknown survival factors such as foreign high seas fishery impact upon the returning chum population may effect the validity of this method of prediction; however, the method should be thoroughly tested before a final evaluation is made.

Kwiniuk River Escapement Data

	X	Y		
Year	Pink Escapement	Chum Escapement		Year
1965[3/]	15,834	26,661		1967
1966	10,864	16,958		1968
1967	3,587	19,687		1969
1968	128,580	68,004		1970
1969	56,683	Est. 1 32,706	Avg.	1971
		Est. 2 39,580	36,143	
1970	235,131	Est. 1 135,671	Avg.	1972
		Est. 2 110,424	123,048	

1/ Historical data from 1968 and 1969 research project reports.

2/ Method described in Forecasting Chum Salmon Returns Based upon Pink Salmon Abundance of the Same Brood Year, 1966. Mattson, Chester R., USBCF.

3/ The 1965 tower count was terminated July 19 before the end of the salmon run. The actual count of 8,668 pinks was expanded to include the percent of pinks which pass the tower on an average year after July 19.

$r = .990$

Given: $\sum x = 158.86 \times 10^3$ $\quad\quad$ $\sum y = 131.31 \times 10^3$

$(\sum x)^2 = 25{,}238.09 \times 10^6$ $\quad\quad$ $\sum xy = 9{,}420.95 \times 10^6$

$\sum x^2 = 16{,}914.42 \times 10^6$ $\quad\quad$ $N = 4$

Estimate 1

$Y = b^1x$ (through origin)

	1971		1972
$Y = +.557x$	= 32,706	and	135,671

Estimate 2

$Y = a + ByxX$

	1971		1972
$Y = 17.077 \times 10^3 + .397x$	= 39,580	and	110,424

The correlation coefficient for this data is quite high, .990 of a possible 1,000 for a straight line relationship. However, the number of comparisons available is only four so the results should be viewed with some reservation for the time being and should only be used as an indication of the possible run. It is suggested that a more sophisticated data analysis be performed after the proposed project for identification-separation of Moses Point commercial stocks is completed, at which time the commercial harvest of Kwiniuk chums may possibly be determined and used in a more accurate return figure.

An escapement of between 32,700 and 39,600 chums is indicated for the Kwiniuk River in 1971. This is somewhat higher than the average chum escapement and approximately half the 1970 escapement of 68,000 chum salmon.

The 1969 pink escapement past the Kwiniuk River tower of 36,683 salmon was only exceeded by 128,580 (1968), and 235,131 (1970). Survival conditions for the 1968 brood year of pink salmon allowed a return 1.8 times greater in 1970. Assuming the same increase from the 1969 brood year, the Kwiniuk River return for 1971 is estimated at 100,000 pink salmon.

Aerial Survey Estimates Compared to Tower Counts

One aerial survey of the entire Kwiniuk River was conducted on July 8, 1970. A total of 43,852 chums and 6,000 pinks was tallied on that portion of the river above the tower. The cumulative tower count through July 7 was 31,468 chums and 20,159 pinks. The comparative species number ratios of chum and pink salmon for the tower counts and aerial survey were 0.7:1 (chums) and 3.4:1 (pinks) respectively. This aerial survey estimate of total salmon was 96.6 percent of the accumulated tower count. Survey conditions were rated as fair. The main difficulty was the inability to properly identify the two species under less than optimum survey conditions.

The same pilot and observer conducted a second aerial survey on July 25, 1970, under good survey conditions. A total of 70,400 chums and 131,950 pinks were counted upriver from the tower. The cumulative tower count through July 24 was 66,336 chums and 214,233 pinks. The comparative species number ratios of chum and pink salmon for the tower counts and aerial survey were .9:1 (chums) and 1.6:1 (pinks) respectively. The aerial survey estimate of total salmon was 72 percent of the accumulated tower count. Results are presented in Table 3.

Observations of Salmon Behavior

During the hours from 0600 to 1200 occasional spot checks were made of salmon migration. As in past years, when 24-hour counts were conducted, minimal migration was observed during these hours.

Population Sampling--Age, Sex and Length Data

A total of 306 chums was sampled from the Moses Point commercial fishery and 447 chums were collected by beach seine from the spawning population above the tower to obtain age, sex and length data. The scales collected were aged and the data tabulated in the A-Y-K Salmon Age, Sex and Size Data Report, 1970.

Carcass Survey of Tubutulik River

After the salmon counts were terminated, two crew members went up the Tubutulik River approximately 25 miles to a point one mile downriver from the mouth of Chukajak Creek. On the trip downriver, July 30, a total of 6,995 pink and 1,234 chum salmon carcasses were counted from this point to the mouth of the Tubutulik River for a ratio of 5.7:1 respectively. An

aerial survey of the Tubutulik River on July 25 resulted in a total count of 136,590 pink and 38,200 chum salmon, a ratio of 3.57:1, which was comparable to the final tower count ratio of 3.45:1.

DISCUSSION

The differences between the above ratios and the Tubutulik River carcass count ratio were logically the result of the upstream spawning of chums which had no chance to be counted on the carcass survey. The chums in this area travel upstream further and spawn in small side streams more frequently than do the pinks which tend to spawn in the deeper water of the lower river.

In 1970 the water level of the river was relatively high and a sand bar separating the two channels was submerged several times at high tide. When the sand bar was submerged, it was possible for salmon moving up or down the secondary channel, blocked by a beach seine, to pass over the sand bar unobserved and not be counted. Most of the high hourly counts resulted from fish gathering in deep water below the tower, then passing through the shallow water in front of the tower in relatively large schools.

Salmon bound for the Kwiniuk and Tubutulik Rivers are harvested in the nearby Moses Point commercial fishery. Further research is necessary to enable managment personnel to identify these separate stocks in order to define the effects of the commercial fishery upon the Kwiniuk River escapement. This would allow a more precise management of the Moses Point commercial fishery.

The Kwiniuk River counting tower project was financed by state management funds in 1970.

This project has been the basic source of information concerning the timing of and trends in the size of the local chum and pink salmon runs. This data has been especially valuable in the management of the Norton Sound fishery.

SUMMARY

1. For the sixth consecutive year, a counting tower project on the Kwiniuk River, A typical Norton Sound stream, was operated primarily for the purpose of obtaining the daily and seasonal timing and magnitude of the salmon runs which can generally be applied toward management of the Norton Sound fisheries.

2. An expanded total of 68,004 chum and 235,131 pink salmon were recorded as passing the tower in 1970. The peaks of the chum run occurred on July 2-6 and July 14-17 while the pink run peaked during the period of July 15-17. The 1970 counts were the largest for both chum and pink salmon during the 1965-1970 period of counting tower operation.

3. Two aerial survey estimates were 96.6 percent and 72 percent of the accumulated tower counts for selected time periods.

4. Water levels of the river were generally high this year. Occasional flooding of a sand bar in the middle of the river may have resulted in some salmon passing the tower without being counted.

5. Age, sex and size information was collected from both the commerical fishery and the spawning population above the tower.

6. A carcass survey of the nearby Tubutulik River was conducted on July 30 after counting at the tower was terminated. The ratio of pinks to chums was 5.7:1 respectively.

Figure 1 . Map of the Kwiniuk River, Alaska

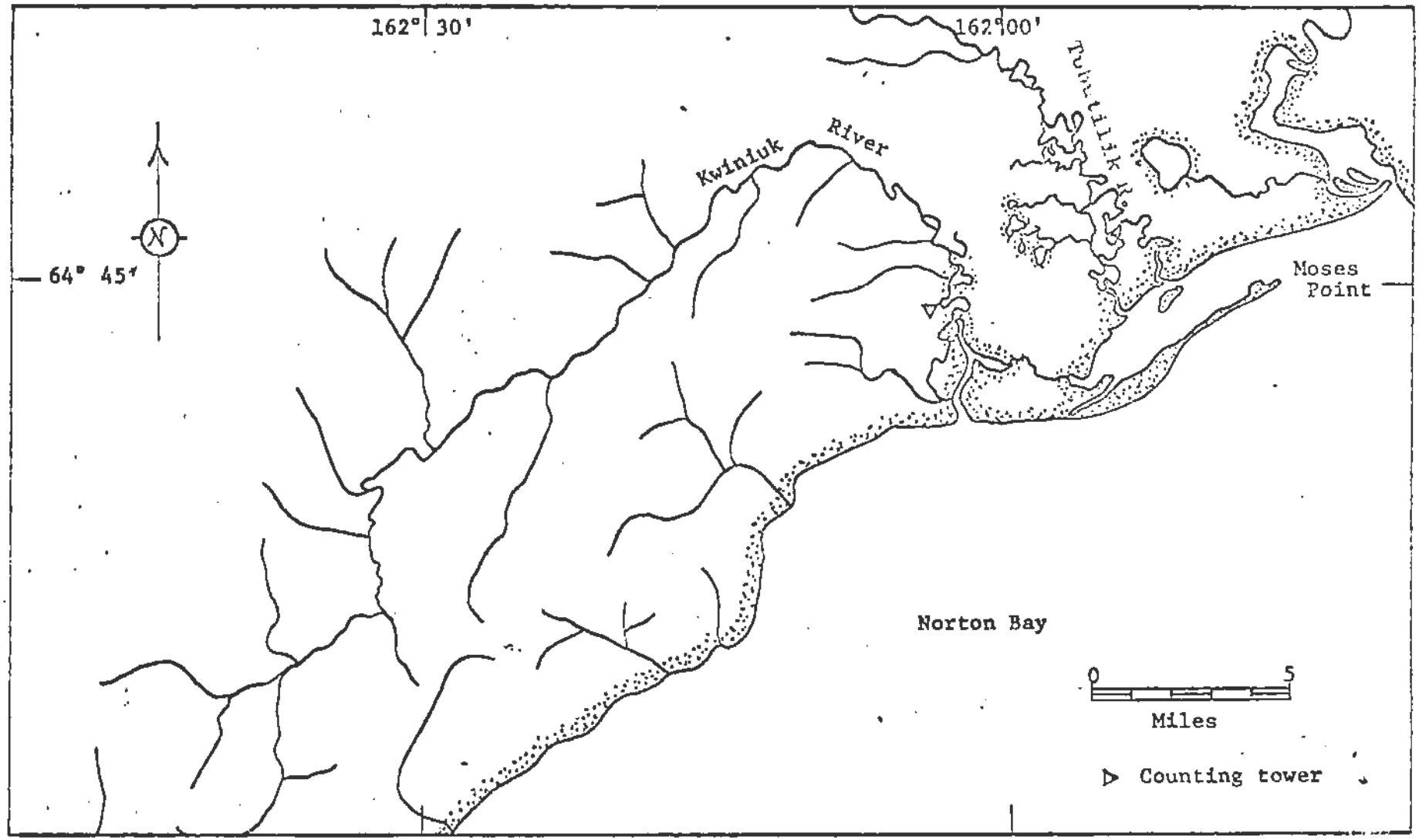

Figure 2. Daily migration patterns of chum and pink salmon, Kwiniuk River, 1970

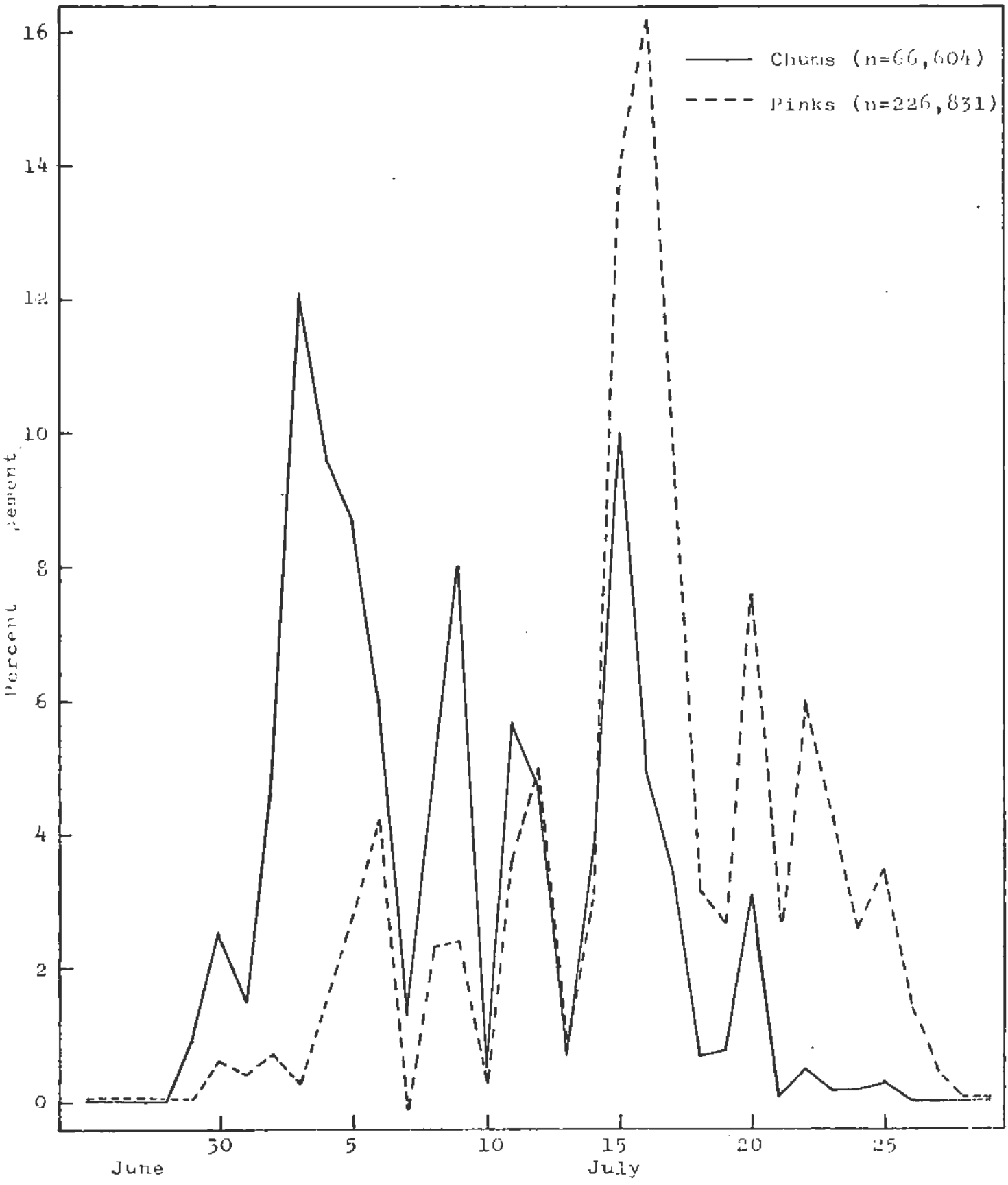

Table 1. Kwiniuk River daily-hourly counts and percentages, 1970.

Species: Chum

Hour / Date		0	1	2	3	4	5	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	% of Total run
June	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--	2	--
	26	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--
	27	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--	--	0	--
	28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--
	29	--	--	38	--	--	--	--	--	459	86	18	19	--	--	--	--	8	--	628	0.9
	30	2	18	13	1	--	--	649	--	--	12	--	4	--	2	--	20	498	438	1657	2.5
July	1	98	0	5	--	--	--	--	--	--	--	--	--	167	32	--	27	191	505	1025	1.5
	2	1809	71	13	1	--	1	--	--	62	161	8	--	27	19	46	149	548	178	3093	4.6
	3	805	230	21	39	6	-3	26	973	6	1487	952	250	724	1061	586	302	344	238	8047	12.1
	4	1203	382	99	129	164	72	1	157	10	150	414	1999	438	523	327	113	85	140	6406	9.6
	5	160	98	62	126	9	28	--	--	64	128	134	201	255	161	1165	1216	1057	962	5826	8.7
	6	56	21	23	62	400	102	7	--	40	247	103	1107	250	-58	35	464	457	581	3897	5.9
	7	-17	-15	-34	-12	-17	-36	--	--	--	--	2	48	674	32	23	104	11	109	872	1.3
	8	2	-6	--	--	--	--	-3	--	--	82	843	1064	223	287	583	109	37	6	3227	4.8
	9	3	--	--	--	--	--	--	--	--	2	100	20	15	11	886	3864	397	19	5317	8.0
	10	5	--	--	1	--	--	--	--	--	--	--	25	98	128	65	7	15	6	350	0.5
	11	1	--	--	8	--	--	--	--	96	48	--	--	14	688	1006	1855	75	27	3818	5.7
	12	14	5	2	--	--	--	--	--	--	48	327	127	24	181	756	302	896	443	3125	4.7
	13	9	-5	--	1	--	--	5	19	15	11	6	16	76	58	136	94	27	10	478	0.7
	14	1	--	--	--	--	--	163	438	347	3	15	36	12	45	45	216	618	582	2521	3.8
	15	127	16	23	70	20	15	12	21	83	1005	196	91	100	199	469	1013	2310	874	6644	10.0
	16	176	16	41	245	124	52	5	9	18	21	156	467	564	614	623	144	22	30	3327	5.0
	17	26	10	8	3	5	2	18	527	553	364	476	203	5	--	--	34	53	15	2302	3.5
	18	--	--	--	--	--	--	--	--	44	20	7	32	172	79	21	56	32	25	488	0.7
	19	8	21	1	4	--	--	--	3	17	90	137	72	117	53	28	9	-1	--	559	0.8
	20	8	6	4	1	--	--	10	57	11	276	798	475	124	18	109	112	23	17	2049	3.1
	21	--	--	--	--	--	--	4	12	2	--	4	8	2	1	--	1	4	6	44	0.1
	22	5	4	--	12	15	7	4	8	37	38	--	7	3	93	87	15	3	7	345	0.5
	23	41	2	1	7	6	--	--	--	1	2	2	1	4	15	19	4	7	2	114	0.2
	24	3	1	2	1	--	--	--	2	4	--	--	1	1	4	46	52	27	16	160	0.2
	25	17	1	3	12	29	4	--	2	2	8	7	1	1	0	10	76	20	16	209	0.3
	26	2	4	1	6	4	5	1	1	0	1	2	3	1	0	6	2	--	--	39	--
	27	1	5	2	1	2	--	--	--	--	1	--	1	--	--	1	1	--	--	15	--

Table 1. (continued) Kwiniuk River daily-hourly counts and percentages, 1970.

Species: Chum (continued)

Hour	0	1	2	3	4	5	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	% of Total run
Date																				
July 28	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	2	--	--	3	--
29	--	--	--	1	--	1													2	--
Hourly Totals	4580	885	328	719	767	250	902	2229	1871	4291	4707	6278	4092	4246	7078	10363	7766	5252	66604	99.7
% of Total run	6.9	1.3	0.5	1.1	1.2	0.4	1.4	3.3	2.8	6.4	7.1	9.4	6.1	6.4	10.6	15.6	11.7	7.9	100.1	

Species: Pink

June 25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	3	--
26	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--
27	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--
28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	1	--
29	--	--	--	--	--	--	--	2	22	6	--	--	--	--	--	--	--	--	30	--
30	28	13	9	20	--	--	40	--	--	1	--	--	5	4	--	--	31	--	151	0.06
July 1	20	4	15	--	3	--	--	--	--	--	--	--	5	--	--	7	14	32	100	0.04
2	26	--	--	1	--	--	--	--	--	4	--	--	--	9	32	36	52	7	167	0.07
3	50	32	8	16	--	--	--	38	--	85	50	10	32	17	34	30	125	104	631	0.3
4	398	619	45	12	38	6	4	3	1	20	94	644	366	401	346	233	146	171	3547	1.6
5	174	113	220	226	9	29	--	--	26	62	86	152	225	177	2302	873	894	738	6306	2.8
6	72	33	19	277	1810	491	16	--	74	1060	953	2551	90	-1597	370	961	1221	1063	9464	4.2
7	-240	-222	-735	-137	-88	-162	--	--	1	--	7	30	602	44	79	199	51	317	-254	-0.1
8	15	-26	3	--	--	--	-1	--	--	174	1012	2553	453	397	296	227	78	19	5200	2.3
9	4	--	--	--	--	--	--	--	--	--	27	15	15	5	946	3995	357	6	5370	2.4
10	6	--	1	--	--	--	--	2	--	--	--	29	115	172	264	12	86	43	730	0.3
11	19	4	3	29	--	--	--	--	438	345	27	5	136	1013	3891	2016	154	62	8142	3.6
12	27	5	2	5	1	--	--	--	--	114	1244	630	142	527	2435	1660	3375	1153	11320	5.0
13	30	-33	-6	--	2	--	35	66	104	56	34	61	135	129	294	745	162	65	1879	0.8
14	5	--	--	--	--	--	214	927	792	53	41	84	74	595	788	528	1230	1390	6721	3.0

Table 1. (continued) Kwiniuk River daily-hourly counts and percentages, 1970.

Species: Pink (continued)

Hour / Date	0	1	2	3	4	5	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	% of Total run
July 15	612	171	187	535	251	151	51	48	219	3245	1618	610	614	2722	4643	4638	5865	4980	31160	13.7
16	1309	255	468	867	391	187	91	133	468	2912	1023	1531	5280	5712	4788	7797	1712	1730	36654	16.2
17	342	108	74	53	81	46	237	6057	5275	3902	2165	1136	245	8	30	917	615	124	21415	9.4
18	24	--	1	--	--	--	19	36	312	97	35	148	1630	1008	559	2110	816	390	7185	3.2
19	108	23	11	17	--	3	3	10	113	1220	878	970	872	536	357	652	141	114	6028	2.7
20	76	49	62	125	96	123	46	416	220	1962	3694	3264	2196	1071	2579	834	248	136	17197	7.6
21	5	3	18	177	126	118	57	79	164	76	146	886	523	446	361	767	1140	995	6087	2.7
22	163	127	132	126	97	63	235	261	1002	2723	449	824	337	2941	2746	935	118	432	13711	6.0
23	1952	174	68	946	776	84	9	18	46	126	523	152	156	741	2345	527	398	404	9445	4.2
24	102	93	78	46	28	9	31	74	89	28	12	172	210	369	726	2017	1063	683	5830	2.6
25	179	97	74	1082	1342	651	6	20	62	381	172	61	73	29	428	1872	734	713	7976	3.5
26	178	115	69	821	473	106	48	44	28	26	194	215	19	83	823	27	36	32	3337	1.5
27	29	7	6	566	334	55	12	16	28	19	17	21	7	5	14	4	7	19	1166	0.5
28	7	4	5	5	4	2	3	1	2	5	4	7	5		7	13	19	15	117	0.05
29	--	--	--	1	--	1					(not counted)								2	--
Hourly Totals	5730	1768	840	5816	5774	1963	1156	8251	9486	18702	14505	16761	14562	17573	32483	34632	20892	15937	226831	100.2
% of Total Run	2.5	0.8	0.4	2.6	2.5	0.9	0.5	3.6	4.2	8.2	6.4	7.4	6.4	7.7	14.3	15.3	9.2	7.0	99.9	

Table 2. Moses Point commercial catches by date, 1970.

Date	Pink	Chum
6/26	15	2,238
6/27	32	3,595
7/1	9	745
7/2	4	72
7/3	580	4,439
7/4	536	5,059
7/7	1,216	4,056
7/8	1,117	3,338
7/10	830	904
7/11	1,667	1,429
7/13	503	427
7/14	1,293	463
7/15	1,119	799
7/16	1,757	1,062
7/17	679	360
7/18	348	153
7/19	160	116
7/20	646	265
7/21	541	206

Table 3. Estimate of salmon escapements by counting tower and aerial survey methods, Kwiniuk River, 1970.

Date of Survey	Species	Tower Count[1/] Number	Tower Count[1/] Percent Total	Aerial Survey Estimate Number	Aerial Survey Estimate Percent Total
July 8	Chum	31,486	61.0	43,852	88.0
	Pink	20,159	39.0	6,000	12.0
	Total	51,627	100.0	49,852	100.0
July 25	Chum	66,336	23.6	70,400	34.8
	Pink	214,233	76.4	131,950	65.2
	Total	280,569	100.0	202,350	100.0

1/ Cumulative totals through 7/7/70 and 7/24/70.

Appendix Table 1. Daily total cumulative salmon escapement, Kwiniuk River.

Species	Date	Year 1965	1966	1967	1968	1969	1970	1971	1972
Chum	6/18	6							
	6/19		24						
	6/20		50						
	6/21		158						
	6/22		506						
	6/23		759						
	6/24		1,048	5	66				
	6/25		597	24	231		2		
	6/26		1,060	77	1,066	57	17		
	6/27	218	1,189	270	1,812	113			
	6/28	983	1,697	315	2,838	427			
	6/29	2,576	1,768	1,455	3,509	571	645		
	6/30	3,445	2,180	2,148	4,443	1,475	7,302		
	7/1	7,741	5,728	2,739	5,971	2,057	3,327		
	7/2	8,794	7,619	3,027	6,914	2,744	6,420		
	7/3	9,988	8,054	3,491	8,427	3,861	14,467		
	7/4	11,050	10,050	5,647	9,409	6,056	20,873		
	7/5	12,078	11,958	6,157	10,247	7,137	26,699		
	7/6	12,602	13,184	9,605	12,345	8,107	30,596		
	7/7	13,455	13,703	13,008	14,950	9,514	31,468		
	7/8	13,824	15,703	15,691	16,637	10,568	34,695		
	7/9	15,630	17,503	18,513	17,920	11,727	40,012		
	7/10	19,147	17,472	21,487	18,201	12,197	40,362		
	7/11	2,818	19,551	23,459	18,266	12,577	44,180		
	7/12	23,491	24,549	26,165	18,332	15,200	47,305		
	7/13	26,444	27,225	26,473	18,348	14,198	47,783		
	7/14	32,026	27,579	26,495	18,481	14,879	50,304		
	7/15	32,190	28,604	26,532	18,507	16,057	56,948		
	7/16	32,437	28,336	26,584	18,518	16,364	60,275		
	7/17	32,503	28,844	26,598	18,553	17,117	62,577		
	7/18	32,861	29,965	26,625	18,677	18,283	63,065		
	7/19		31,584	26,631	18,732	18,645	63,624		
	7/20		32,154	26,681	18,764	18,856	65,673		
	7/21		32,398	26,661	18,824	19,171	65,717		
	7/22		32,723		18,868	19,311	66,062		
	7/23		32,938		18,893	19,328	66,176		
	7/24		33,030			19,463	66,336		
	7/25		33,137			19,492	66,545		
	7/26		33,153			19,687	66,584		
	7/27		33,184				66,599		
	7/28		33,182				66,602		
	7/29						66,604		
							x 2.1%[1/]		
							= 1,400		
							+ 66,604		
							68,004		

1/ 1970 was the first year of 18 hour counts, 12 noon until 6 a.m. the next day. The average escapement for the hours from 6 a.m. until 12 noon for the years 1965-1969 was 2.1 percent of the total escapement for chums and and 3.66 percent for pink salmon.

Appendix Table 1. (continued) Daily total cumulative salmon escapement, Kwiniuk River.

Species	Date	Year 1965	1966	1967	1968	1969	1970	1971	1972
Pink	6/18								
	6/19								
	6/20								
	6/21								
	6/22								
	6/23								
	6/24								
	6/25						3		
	6/26					17	13		
	6/27					19	16		
	6/28	174			48	41	17		
	6/29	260			214	52	47		
	6/30	220			534	117	198		
	7/1	276		1	755	131	298		
	7/2	314	11	3	1,330	232	465		
	7/3	349	29	4	1,732	378	1,096		
	7/4	396	317	6	2,501	1,165	4,643		
	7/5	388	517		3,141	2,259	10,949		
	7/6	390	533		4,777	3,974	20,413		
	7/7	412	568	18	13,719	6,415	20,159		
	7/8	558	607	45	38,560	8,683	25,359		
	7/9	650	673	521	67,509	11,406	30,729		
	7/10	820	683	718	81,776	12,684	31,459		
	7/11	1,120	722	1,282	105,977	13,539	39,601		
	7/12	1,526	758	1,926	112,512	15,477	50,921		
	7/13	1,653	817	2,685	112,851	18,250	52,800		
	7/14	2,856	898	3,138	112,775	19,379	59,521		
	7/15	4,488	1,205	3,160	114,032	25,056	90,681		
	7/16	7,301	1,008	3,230	114,546	27,850	127,335		
	7/17	7,456	1,206	3,348	116,700	33,907	148,750		
	7/18	7,571	1,771	3,380	120,920	40,106	155,935		
	7/19	8,668	3,269	3,406	124,038	43,083	161,963		
	7/20		3,894	3,432	125,376	46,812	179,160		
	7/21		4,190	3,567	126,616	51,129	185,247		
	7/22		5,558	3,587	127,530	53,363	198,958		
	7/23		6,777		127,994	53,958	208,403		
	7/24		7,843		128,580	54,927	214,233		
	7/25		10,015			55,403	222,209		
	7/26		10,691			56,683	225,546		
	7/27		10,798				226,712		
	7/28		10,864				226,829		
	7/29						226,831		
							x 3.66%[1/]		
							= 8,300		
							+ 226,831		
							235,131		

Appendix Table 2. Total counts by hour showing percentage of total count for the years 1965-1969.

Species: Chums

Year	1965		1966		1967		1968		1969		
Hour	Count	%	Count	%	Count	%	Count	%	Count	%	All years
00-01	2043	6.27	904	3.67	880	3.18	2214	11.7	753	3.8	5.72
01-02	1938	5.95	1255	5.10	917	3.31	1355	7.1	356	1.8	4.65
02-03	627	1.93	967	3.93	487	1.76	735	3.9	84	0.4	2.38
03-04	405	1.24	654	2.66	353	1.27	720	3.8	284	1.4	2.07
04-05	186	0.57	224	0.91	111	0.40	314	1.7	279	1.4	0.99
05-06	131	0.40	58	0.24	123	0.44	27	0.1	292	1.5	0.53
06-07	121	0.37	13	0.005	60	0.22	40	0.2	46	0.2	0.20
07-08	66	0.20	80	0.33	53	0.19	66	0.3	181	0.9	0.38
08-09	60	0.18	-25	0.0	16	0.06	22	0.1	186	0.9	0.24
09-10	35	0.11	-19	9.0	67	0.24	33	0.2	72	0.4	0.19
10-11	118	0.36	7	0.003	287	1.04	22	0.1	51	0.3	0.36
11-12	98	0.30	-2	0.0	-161	-0.58	35	0.2	77	0.4	0.06
12-13	305	0.94	161	0.66	22	0.08	-4	0.0	161	0.8	0.49
13-14	1523	4.68	147	0.60	495	1.79	69	0.4	1128	5.7	2.63
14-15	3386	10.40	483	1.96	496	1.79	440	2.3	963	4.9	4.27
15-16	1677	5.15	792	3.22	788	2.84	833	4.4	749	3.8	3.88
16-17	1556	4.78	1369	5.57	2937	10.6	879	4.6	1830	9.3	6.97
17-18	3961	12.16	1962	7.98	2519	9.09	698	3.7	2180	11.0	8.78
18-19	2777	8.53	2031	8.25	2304	8.31	1282	6.8	1995	10.1	8.39
19-20	2387	7.33	3392	13.78	3836	13.8	1947	10.3	1606	8.1	10.66
20-21	1863	5.72	2798	11.36	3600	13.0	1786	9.4	2109	10.7	10.03
21-22	2289	7.03	3523	14.30	3093	11.2	1409	7.4	1770	9.0	9.78
22-23	3082	9.47	2226	9.06	2412	8.7	1462	7.7	1180	6.0	8.18
23-24	1927	5.92	1574	6.40	2017	7.28	2586	13.6	1470	7.4	8.12
Totals	32561	99.99	24574	99.98	27712	100.5	18970	100.0	19802	100.2	99.95

Appendix Table 2. (continued) Total counts by hour showing percentage of total count for the years 1965-1969.

Species: Pinks

Year	1965		1966		1967		1968		1969		All years
Hour	Count	%	Count	%	Count	%	Count	%	Count	%	%
00-01	526	6.76	22	0.02	140	4.1	9974	7.6	3211	5.6	4.81
01-02	267	3.43	310	3.08	247	7.3	10457	8.1	1432	2.5	4.88
02-03	179	2.30	603	6.00	107	3.1	2403	1.8	270	0.5	2.74
03-04	142	1.82	428	4.25	113	3.3	2319	1.7	2227	3.9	2.99
04-05	80	1.03	57	0.06	7	0.2	2161	1.6	1833	3.2	1.21
05-06	81	1.04	28	0.03	15	0.3	661	0.5	1325	2.3	0.83
06-07	58	0.75	10	0.01	14	0.3	431	0.3	158	0.3	0.33
07-08	50	0.64	3	0.00	19	0.5	1861	1.4	2300	4.0	1.30
08-09	22	0.28	4	0.00	5	0.1	796	0.6	842	1.5	0.49
09-10	17	0.22	-7	0.00	10	0.3	152	0.1	102	0.2	0.16
10-11	87	1.12	-310	0.00	15	0.4	317	0.2	116	0.2	0.38
11-12	95	1.22	-2	0.00	26	0.7	287	0.2	0	0.0	0.42
12-13	90	1.16	-1	0.00	21	0.6	206	0.2	173	0.3	0.45
13-14	142	1.82	11	0.01	74	2.2	1395	1.1	2136	3.7	1.76
14-15	459	5.90	26	0.03	162	4.7	1796	1.4	1529	2.7	2.94
15-16	598	7.68	40	0.04	80	2.4	3711	2.9	2142	3.7	3.34
16-17	655	8.41	490	4.87	119	3.5	7701	6.0	4346	7.6	6.07
17-18	526	6.76	1221	12.13	227	6.6	14492	11.2	3445	6.0	8.53
18-19	546	7.01	851	8.45	240	7.1	6524	5.1	3153	5.5	6.63
19-20	534	6.86	1323	13.18	551	16.2	19821	14.8	4830	8.4	11.88
20-21	580	7.45	1822	18.18	377	11.1	8767	6.7	7928	13.8	11.44
21-22	770	9.89	1609	15.98	300	8.7	9921	7.6	49391	8.6	10.15
22-23	768	9.87	926	9.21	314	9.2	10137	7.8	3451	6.0	8.41
23-24	513	6.59	602	5.98	242	7.1	13092	10.1	5543	9.6	7.87
Totals	7785	100.1	10066	101.51	3425	100.0	129382	99.0	43615	100.1	100.01

Appendix Table 3. Chum and pink salmon escapements,[1/] Kwiniuk River, 1965-1970.

Species	1965	1966	1967	1968	1969	1970[2/]
Chum	26,634	32,786	24,444	18,813	19,687	68,004
Pink	8,301	10,629	3,508	126,764	56,683	235,131

1/ Tower count minus upriver subsistence catch.
2/ Expanded data.